REMARKS

Claims 1, 3-15, 18-35, 39, 40, 44-47 and 52 are pending in this application. By this Amendment, claims 1, 3-15, 18-35, 39, 40, 44-47 and 52 are amended and claims 16, 17, 37, 38 and 48-51 are canceled.

Counsel thanks the Examiner the courtesies extended during the telephone interview conducted on May 2, 2007. The inventor, Mr. Robert Winsor, participated in the telephone interview and during the discussion counsel and Mr. Winsor discussed a new tact to take in the claims, as well as the failures in the cited art of record to render the claims unpatentable.

The outstanding Office Action rejects claims 1, 3-10, 12-17, 19-31, 33-38, 40 and 44-52 under 35 U.S.C. 192(a) as being unpatentable over U.S. Patent No. 5,786,923 to Doucet et al. ("Doucet") in view of Koyama et al. (the cited publication to Koyama).

It is noted that amendments are made herein to numerous dependent claims to correct a typographical error that has been overlooked (the term "claim" was missing from the preamble of most of the original dependent claims).

As discussed during the telephone interview with the Examiner, the free space optical communication (FSOC) system and method according to the present invention is a departure from current FSOC system implementations. Current FSOC systems use lasers as the means of emitting light from the source to the destination across free space. In a laser-based FSOC system, adaptive optics may be used to correct for atmospheric turbulence. FSOC system designers have not been motivated to use phase-incoherent light sources, such as an LED, because it would require additional special hardware that is not "Commercial Off The Shelf" (COTS). Specifically, current FSOC system design techniques would find that the bandwidth of an LED is too wide, necessitating the use of filters that would in turn greatly attenuate the optical signal. This would therefore in turn require use of an additional optical amplifier. Moreover, packaging of LEDs is different from a laser-based component that can be satisfied with a COTS product for a FSOC system.

Nevertheless, there are disadvantages to using lasers in a FSOC system. The light output by the laser is coherent and thus susceptible to fading caused by turbulence in the atmosphere. The speckle nature of a laser beam shape makes the use of adaptive optics to compensate for the effects of scintillation very challenging due to the phase ambiguity of the light, and spot break-up at the focal plane (making it more difficult to point and track a laser beam).

By contrast, as set forth in the claims of the present application, a FSOC system and method is provided that uses a phase-incoherent light source, such as superluminescent LED (SLED) to mitigate scintillation caused by atmospheric turbulence between the source unit and a destination unit. Moreover, the claims are amended herein to emphasize that the phase-incoherent light beam is modulated with data so as to communicate data from the source unit to the destination unit at a date rate of no less than one Gb/s. The phase-incoherent light source is required for FSOC in order to mitigate the effects of scintillation-caused fading at the destination unit at such a high data rate. It would not be possible to perform FSOC at such very high data rates using a laser light source without significant signal drop-outs and related loss of data because the atmospheric scintillation would make the optical link unreliable at such high data rates.

Support in the present application for the aforementioned claim amendments can be found at page 7, line 21 to page 8, line 17, and at page 9, line 12 to page 10, line 12.

The outstanding Office Action combines the teaching of Doucet with the newly cited article to Koyama in rejecting the claims as they stood prior to this Amendment. Doucet discloses FSOC techniques, and mentions in passing at column 4, lines 52-56, possible use of "non-coherent light", as one of several types of light sources that may be used in its system. Doucet makes no mention of using an LED, and provides no discussion of the advantages of using a phase-incoherent light source, nor does Doucet acknowledge that a long-range FSOC link will exhibit scintillation which could be mitigated with phase-incoherent light. Furthermore, Doucet does not teach or suggest modulating a light source with data to achieve communication of data at a data rate no less than one Gb/s.

The Koyama reference was cited for its alleged relevance to the linewidth of an LED. However, the claimed language concerning a linewidth of the LED light source has been removed from the claims. No further discussion of Koyama is believed to be necessary.

The other references that have been cited and relied upon in previous Office Actions also make no teaching or suggestion of modulating a phase-incoherent light beam with data for communicating data over free space from a source to a destination at a data rate no less than one Gb/s. The data rate capability discussion in the specification of the present application (to which reference is made above) assumes 100% sea-level atmosphere over the entire link distance, and on Earth such link distances would require using regions of the atmosphere with significantly less density, and therefore the data rate limitation is significantly reduced.

It is respectfully submitted that the system and method now set forth in the claims of this application are novel and non-obvious over the prior art of record. Again, there is no teaching in any of the prior art references of modulating a phase-incoherent light beam with data in order to communicate data at a data rate no less than one Gb/s across free space. Even in view of the teachings of Doucet, it is respectfully submitted that one with ordinary skill in the art would not be motivated to use a phase-incoherent light source, such as a SLED, for FSOC at data rates no less than one Gb/s. Despite the casual reference to incoherent light in Doucet, to select a phase-incoherent light source such as a SLED would require additional hardware not needed for a laser based system, and consequently goes against current thinking in FSOC system design. Doucet does not even contemplate why one light source would be selected over another. Nevertheless, it has been discovered through testing by the inventor that the extra hardware is worthwhile for certain FSOC applications (very high data rates) because a phase-incoherent light source such as a SLED can achieve very high data rates across relatively long distances that could not otherwise be achieved by a laser-based system due to the scintillation issues.

While it is known in the art to use adaptive optics in a laser-based FSOC system to mitigate the effects of scintillation, for the vast majority of long-range FSOC systems, which typically have small apertures and adaptive optics is therefore only used at the receiver, adaptive optics do not help light reach its destination. Adaptive optics techniques usually only improve

the quality of the coupling of the signal into its receiver (when the signal manages to reach its destination). By contrast, the use of phase-incoherent light helps the light reach its destination. Therefore, using phase incoherent light offers benefits above and beyond adaptive optics, making it a better choice for FSOC design than adaptive optics for many applications.

There are still further benefits to the system and method of the present invention. Using phase-incoherent light for high data rate FSOC applications simplifies optical communication packet framing as a result of the reduced scintillation experienced by the phase-incoherent light. Less packet interleaving is needed when using Forward Error Correction (FEC). In addition, achieving synchronization between the source and the destination is much easier with phase-incoherent light than with today's laser-based FSOC techniques.

Based upon the foregoing, it is respectfully submitted that the claims are patentable over the prior art of record, and that all pending claims are in condition for allowance. Formal notice of such is solicited. If the Examiner has any questions, the Examiner is respectfully requested to contact the undersigned at the number listed below.

The Commissioner is hereby authorized to charge payment of any additional fees required for the above-identified application or credit any overpayment to Deposit Account No. 05-0460.

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Respectfully submitted by:

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